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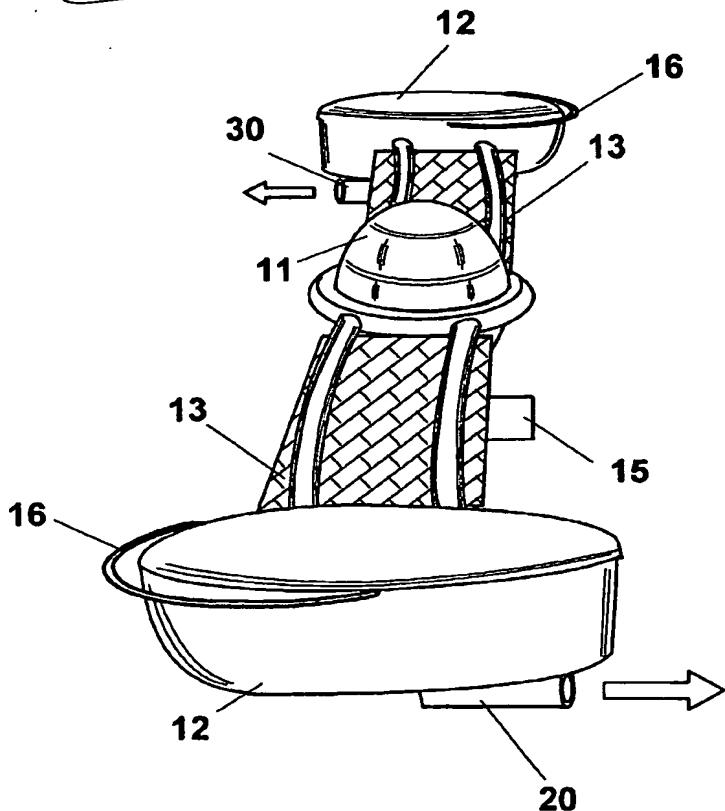
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(54) Title: FLOATING SELF-PROPELLED CLEANING DEVICE FOR WATER SURFACES



(57) Abstract: A floating self-propelled cleaning device (10) for water surfaces, in particular swimming pools, comprises a central floating body (11) and two side floating elements (12) to it connected at opposite sides by two arms (14) to which two net-shaped collecting containers (13) are fastened. The net-shaped containers (13) have openings (17) that allow the inlet of impurities, but prevent the outlet thereof during possible stops or under the action of waves that can occur during the travel on the water surface. The floating device (10) is driven by propelling means (20) and (30) that substantially cause the side floating elements (12) to rotate about an instantaneous centre of rotation located approximately at the central body (11). The rotation of the side floating elements (12) is associated to a shifting movement caused by at least a distribution element (15) movable with respect to the floating body (10). The sum of these two effects provides a resulting trajectory of the device (10) that causes the net-shaped containers (13) to sweep the whole water surface.

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*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

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TITLE

FLOATING SELF-PROPELLED CLEANING DEVICE FOR WATER SURFACES

DESCRIPTION

Field of the invention

The present invention relates to a floating self-propelled cleaning device for removal of impurities, as leaves or insects, from the water surface of swimming pools, fountains etc.

Description of the prior art

As known, outdoor swimming pools are often made dirty by leaves, powder, insects that fall on the water surface. As a rule, they are periodically manually cleaned at the surface level by a pole with a net.

Furthermore, swimming pools normally comprise a filtration and recirculation system that has the task of intaking the water, filtering it and pumping it depurated and disinfected again in the pool.

These systems, diagrammatically shown in figures 1 and 2, normally comprise "skimmers". Each skimmer comprises an opening 2 in the wall 3 of the pool, for the water intake at the surface level, a removable basket 4, located inside, for keeping the largest floating impurities before that the water reaches one or more filters.

Even if they are cheap and effective, the skimmers are often insufficient, since the water surface movement is slow and is subject to the wind influence that causes the dirt to gather in certain zones of the swimming pool not covered by the skimmers action, and then requiring to remove it manually.

Possible water jets towards the bottom and the sidewalls of the swimming pool can affect the operation of a skimmer, also. Such jets, in fact, create turbulence in

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the pool that affects the surface flow towards the skimmer.

Systems are also known comprising a net connected to a support capable of sliding on the edges of the swimming 5 pool. Such systems are bulky and have the further drawback of requiring the presence of an operator.

Furthermore, floating self-propelled devices exist comprising a collecting container and a propelling system. However, such devices are not much efficient, since they 10 have a purely translational movement that does not allow covering the whole surface of the swimming pool. Furthermore, it is necessary to control and shift them when they meet an obstacle along their path.

Summary of the invention

15 It is therefore a feature of the present invention to provide a floating cleaning device for water surfaces capable of removing from the water surface the impurities, such as leaves and insects, which has not the above-described drawbacks.

20 It is another a feature of the present invention to provide such a device structurally easy and not expensive.

These and other objects are accomplished by the floating self-propelled cleaning device for water surfaces, according to the present invention, whose 25 characteristic is that it comprises:

- a floating body;
- at least one net-shaped collecting container connected to the floating body and having an inlet;
- means for causing said floating body to rotate so that the inlet of said container sweeps a portion of the water surface;
- means for causing a shifting movement to said floating body that serves, together with said

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rotation, to move the floating body and cover all the water surface;

- at least one energy source for said means for causing a rotation to the floating body.

5 Preferably, the means for causing a rotation to the floating body comprises at least one jet means suitable for generating a thrust that causes the rotation of the floating body about an instantaneous centre of rotation.

10 Advantageously, the floating body comprises a central body and two side floating elements connected to the central body from opposite sides. The means for causing a rotation comprise two water jets forming a propelling couple with respect to a centre of rotation.

15 Advantageously, the means for causing a shifting movement comprise at least a distribution element movable with respect to the floating body suitable for operating said or each propelling means for generating intermittent thrusts.

20 Preferably, said means for causing a rotation to the floating body comprises a first and a second propelling means arranged at said side floating elements and opposite to each other.

25 Alternatively, said or each propelling means is in a position distanced from the centre of rotation.

Advantageously, the distribution element comprises a blade dipped in water associated to a distribution element selecting alternatively each propelling means. This allows alternating the two forward thrusts for causing the rotation of the floating body together with a shifting component for assuring to sweep the entire water surface.

30 The distribution element can be a cam disk, fixed with respect to a reference system that is external to the cleaning device. In particular, the cam disk has a first portion with larger outer diameter and a second portion

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with lower outer diameter and is located at two switches associated to the two propulsion jets. Therefore, the cam disk, during the rotation of the cleaning device operates only the propulsion jets whose switch is momentarily 5 located at the portion with higher diameter and closes the electrical circuit of that branch leaving open the other branch.

A further exemplary embodiment of the invention provides that the energy distribution means comprises a 10 two-way valve arranged in a central chamber of a deflecting element that directs alternatively a water flow, to two outlets having apertures oriented in opposite directions, in order to generate a thrust in a corresponding direction.

15 Advantageously, at least a feeler pawl is provided suitable for blocking the delivery of energy to the corresponding propelling means when the device meets an obstacle. This way, the self-propelled cleaning device is capable to pass the obstacle, for example, a sidewall of 20 the pool, substantially bouncing off the obstacle same and then starting again to sweep the water surface according to a different trajectory.

25 Preferably, the energy for driving the floating device is supplied by at least one solar panel, arranged between the side floating elements and the central body. The panel can be associated to a storage battery.

#### Brief description of the drawings

The invention will now be illustrated with the following description of an exemplary embodiment thereof, 30 exemplifying but not limitative, with reference to the attached drawings wherein:

- figures 1 and 2 show diagrammatically a skimmer of prior art used for removal of impurities from water surfaces;

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- figure 3 shows in a perspective elevational front view the floating self-propelled cleaning device for water surfaces, according to a first exemplary embodiment of the invention;
- 5 - figure 4 shows a perspective elevational side view of an alternative exemplary embodiment of the device of figure 3;
- figures from 5A to 5D show a possible diagrammatical scheme of operation of the propelling system of the device of figures 3 and 4;
- 10 - figure 6 shows in a perspective elevational front view a further alternative exemplary embodiment of the device of figure 3;
- figures 7 and 8 show respectively a cross sectional view and a partially cross sectioned perspective view of an exemplary embodiment alternative to the figures from 5A to 5D of the propelling system of the floating self-propelled cleaning device;
- figure 9 shows diagrammatically a possible trajectory followed by the device, according to the invention, on a water surface.

Description of the preferred exemplary embodiment

With reference to figure 3 a first exemplary embodiment of a floating self-propelled cleaning device 10 for water surfaces, according to the invention, comprises 25 a central floating body 11 and two side floating elements 12 to it connected at opposite sides. In particular, the two side floating elements 12 are connected to the central body 11 by connecting arms 14 to which two net-shaped 30 collecting containers 13 are connected. Containers 13 can have one-way openings 17 that allow the inlet of impurities into containers 13 same, but block the outlet thereof during possible stops or under the action of waves that can occur during the travel on the water surface.

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In the case of figures 3 and 4, the floating device 10 is driven by propelling means 20 and 30 that substantially cause the side floating elements 12 to rotate about an instantaneous centre of rotation located 5 approximately at the central body 11. This rotation of the side floating elements 12 is associated to a shifting movement caused by at least a distribution element 15 movable with respect to the floating body 10. The sum of these two effects provides a resulting trajectory of the 10 device 10 that causes the net-shaped containers 13 to sweep the whole water surface (figure 9).

These propelling means 20, for causing the rotation, can be located within the floating elements 12 (figure 3) or outside them (figure 4). Alternatively, propelling 15 means 120 can be connected outside central body 11 (figure 6) or can be housed inside it (not shown).

The energy for operating propelling means 20 or 120 is supplied, for example, by a battery (not shown) charged by solar panels 45 (figure 6).

20 Advantageously, propelling means 20 generate alternately opposite thrusts that cause the rotation of the floating body 10. The alternation of the thrusts of the propelling means 20 is made by a distribution element 40 (figure 5A 5D) or 140 (figure 8) that distributes 25 alternately the energy to each propelling means 20 or 30.

In particular, as diagrammatically shown in figures from 5A to 5D, distribution element 40 can be a cam disk that operates alternately the propelling means 20, or 30 respectively, opening or closing the respective electric 30 circuits 23, or 33, by means of switches 21, or 31.

In particular, cam disk 40 has a first portion 41 with larger outer diameter and a second portion 42 with smaller outer diameter. Therefore, during the rotation of the cleaning device 10 the propelling means 20 or 30 is

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operated whose switch 21, or 31, respectively, contacts the portion with higher diameter 41 of cam disk 40.

Alternatively, the energy distribution means can comprise a two-way valve 110 (figure 7) having a deflector 140 that directs alternately, to two outlets 120 and 130 with apertures oriented in opposite directions, a water flow that generates the thrust necessary to cause the rotation of the floating device 10.

According to a further aspect of the invention, a 10 feeler pawl 16 (figure 4) is provided that interrupts the delivery of energy to the corresponding propelling means 20 or 30 when the device 10 meets an obstacle, for example a sidewall 50 of the pool. This way, the self-propelled 15 cleaning device 10 is capable of bouncing off the obstacle 50 and then of starting again to sweep the water surface according to a different trajectory.

The foregoing description of a specific embodiment will so fully reveal the invention according to the conceptual point of view, so that others, by applying 20 current knowledge, will be able to modify and/or adapt for various applications such an embodiment without further research and without parting from the invention, and it is therefore to be understood that such adaptations and 25 modifications will have to be considered as equivalent to the specific embodiment. The means and the materials to realise the different functions described herein could have a different nature without, for this reason, departing from the field of the invention. It is to be understood that the phraseology or terminology employed 30 herein is for the purpose of description and not of limitation.

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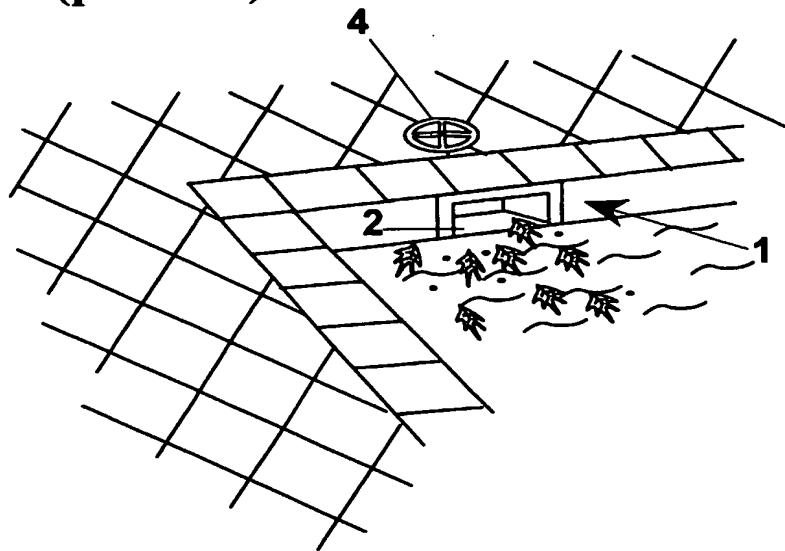
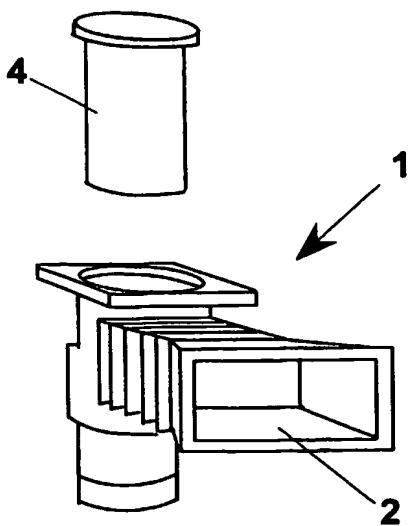
CLAIMS

1. Floating self-propelled cleaning device for water surfaces **characterised in that** it comprises:
  - a floating body;
  - at least one net-shaped collecting container connected to said floating body and having an inlet;
  - means for causing said floating body to rotate so that the inlet of said container sweeps a portion of the water surface;
  - means for causing a shifting movement to said floating body that serves, together with said rotation, to move the floating body on the water surface;
  - at least one energy source for said means for causing a rotation to the floating body.
2. Device, according to claim 1, wherein said means for causing said floating body to rotate comprises at least one jet means suitable for generating a thrust that causes the rotation of said floating body about an instantaneous centre of rotation.
3. Device, according to claim 1, wherein said floating body comprises a central body and two side floating elements connected to said central body from opposite sides.
4. Device, according to claim 1, wherein said means for causing a shifting movement comprises at least a distribution element movable with respect to said floating body suitable for cooperating with said or each propelling means for generating intermittent thrusts.
5. Device, according to claim 1, wherein said means for causing a rotation comprises a first and a second propelling means arranged at said side floating elements and opposite to each other, said means for causing a rotation comprising two water jets forming a propelling couple with respect to said centre of rotation.

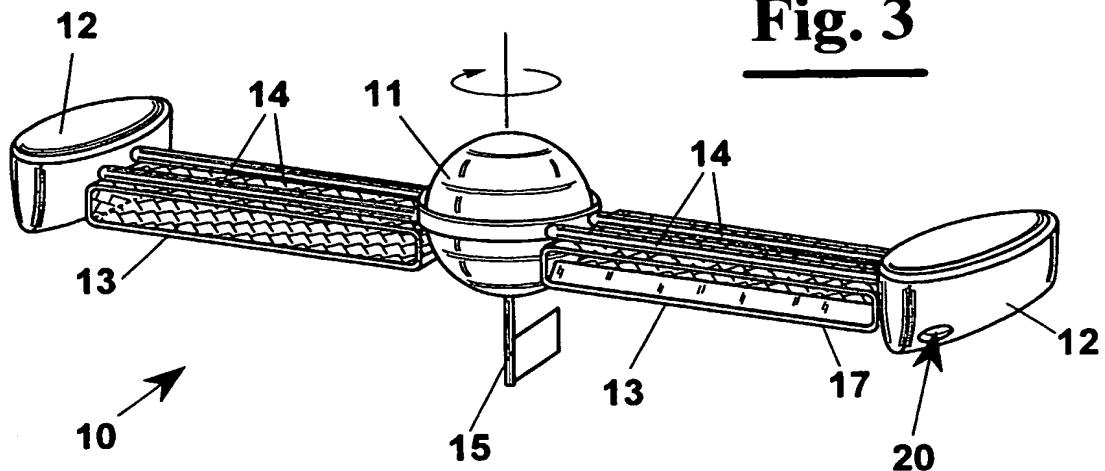
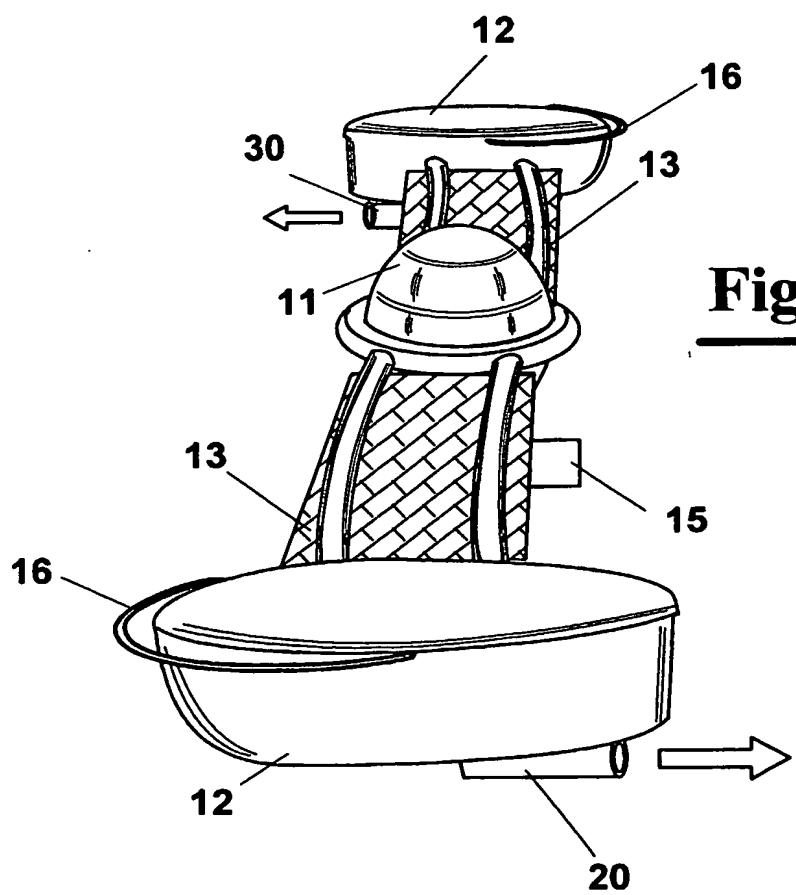
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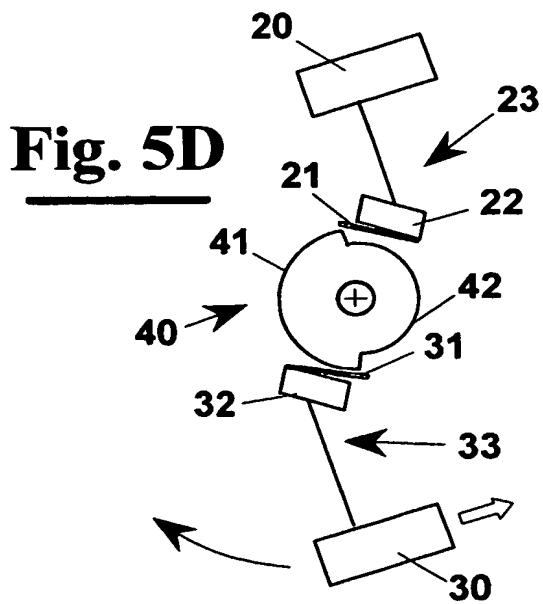
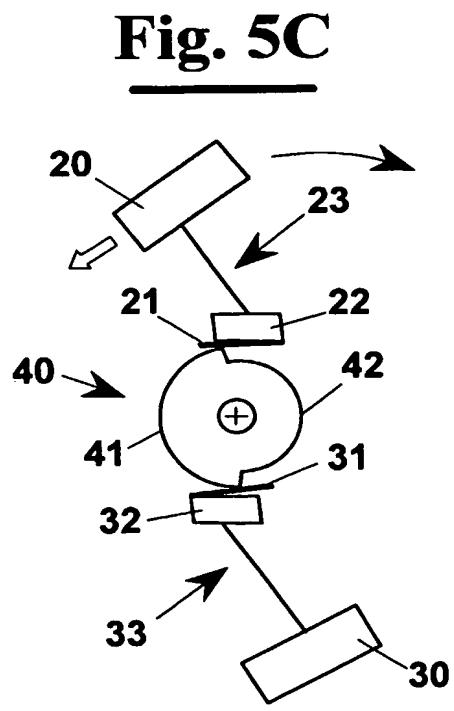
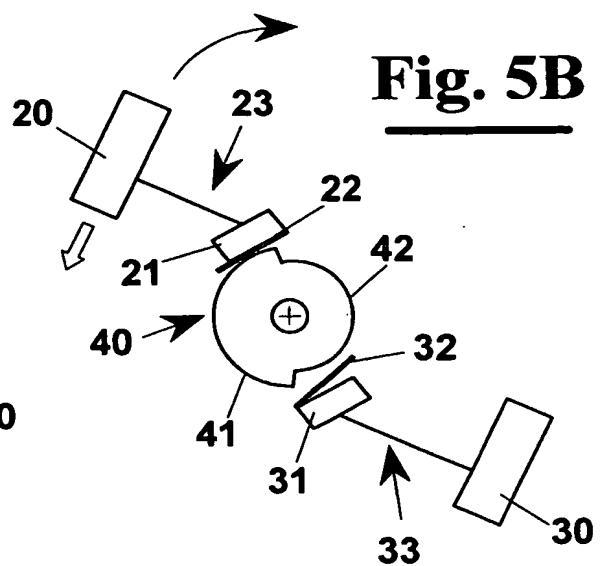
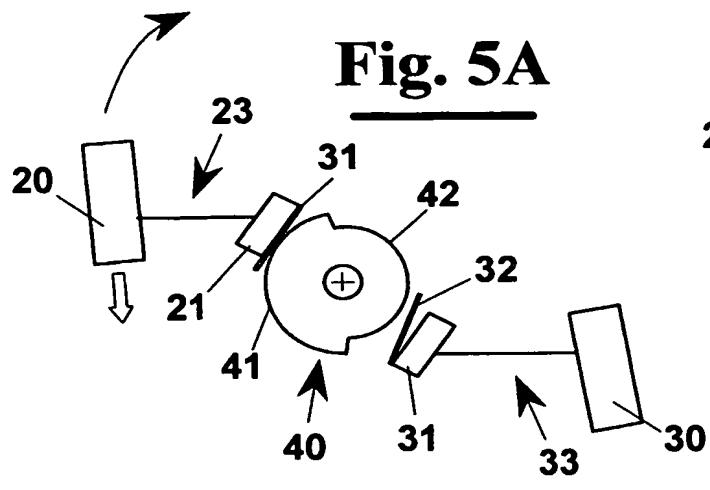
6. Device, according to claim 2, wherein said or each propelling means is in a position distanced from the centre of rotation.
- 5 7. Device, according to claim 1, wherein said means for causing a shifting movement comprises at least a distribution element movable with respect to said floating body suitable for operating said or each propelling means for generating intermittent thrusts.
- 10 8. Device, according to claim 7, wherein said distribution element comprises a blade dipped in water associated to a distribution element selecting alternatively each propelling means
- 15 9. Device, according to claim 8, wherein said distribution element is a cam disk that operates alternatively each propelling means by a switch.
- 20 10. Device, according to claim 7, wherein said distribution element is a two-way valve arranged in a central chamber of a deflecting element that directs alternatively a water flow to two outlets having apertures oriented in opposite directions in order to generate a thrust in corresponding opposite directions.
- 25 11. Device, according to claim 1, wherein at least a feeler pawl is provided suitable for blocking the delivery of energy to a corresponding propelling means when the device meets an obstacle.

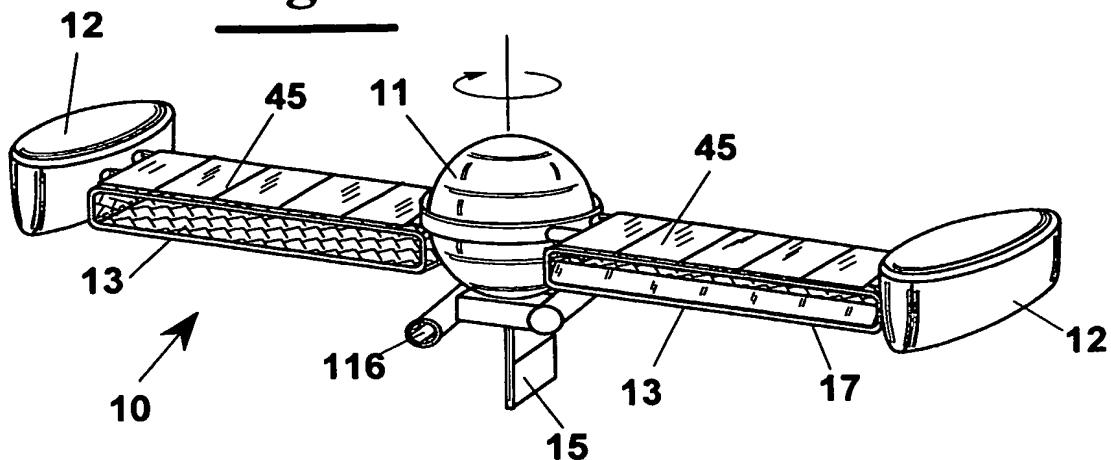
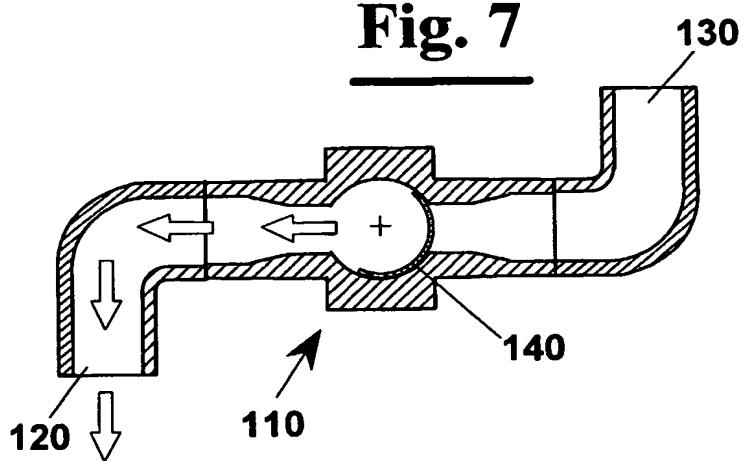
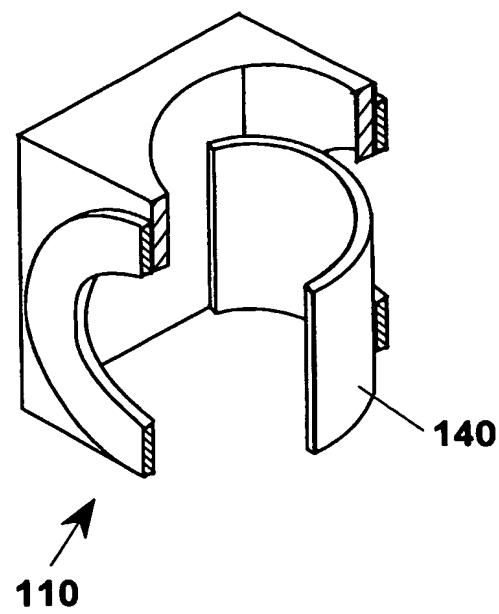
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**Fig. 1****(prior art)****Fig. 2****(prior art)**

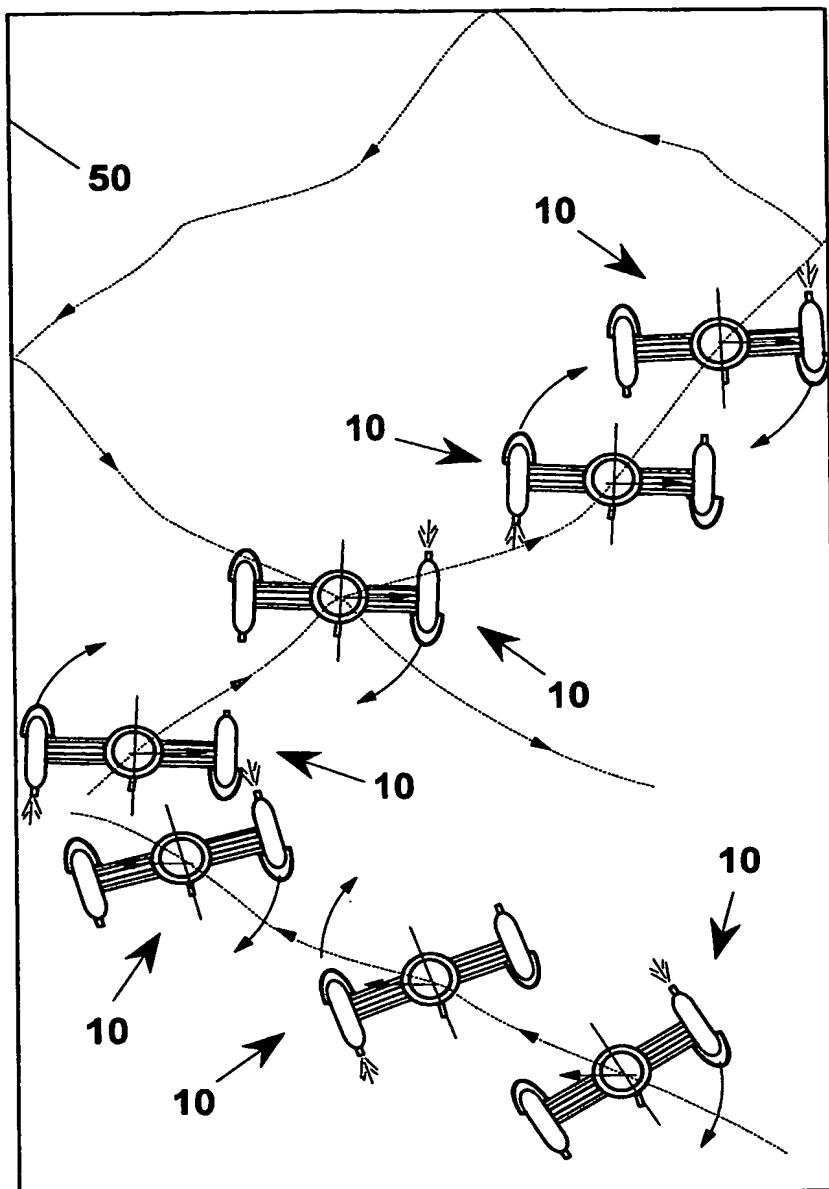
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Fig. 3Fig. 4



**Fig. 6****Fig. 7****Fig. 8**

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**Fig. 9**

## INTERNATIONAL SEARCH REPORT

PCT/IB 03/04670

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 7 E04H4/12 E04H4/16

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10/532420

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 E04H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 91 09193 A (MORIARTY JOHN BARRY) 27 June 1991 (1991-06-27) page 4, line 10 -page 6, line 27; figures 1-6 ---	1-7
X	FR 2 796 576 A (HABIF JACQUES ALEXANDRE) 26 January 2001 (2001-01-26) page 1, line 11 -page 2, line 40; figures 1-5 ---	1,3
X	EP 0 936 328 A (HASKI ROBERT DR) 18 August 1999 (1999-08-18) paragraph '0028! - paragraph '0031!; figures 1-4 ---	1,11

 Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

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Date of the actual completion of the international search

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## INTERNATIONAL SEARCH REPORT

Patent document cited in search report		Publication date		Patent family member(s)		Publication date
WO 9109193	A	27-06-1991	WO	9109193 A1		27-06-1991
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			US	6074553 A		13-06-2000

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